Ages:
6th – 8th grade

Duration:
15 minutes

Materials:
- Students' physical participation
- Earth globe and Moon ball for extension

~ LPI Education/Public Outreach Science Activities ~

Facing the Moon

Overview —

Students discover that the Moon's period of rotation (on its axis) is identical to its revolution around the Earth, which is why only one side of the Moon faces the Earth.

Objective —

The students will:
- model the rotation and revolution of the Moon.
- be able to describe the Moon's motions.

Before You Start: Share that this activity and concept are unrelated to Moon phases; if you have covered Moon phases recently or are about to do so, you may need to reinforce this, to avoid confusion.

Activity —

Ask the students what they know about how our Moon moves.

- *Does it orbit something? What? How long does it take for one orbit?*

Confirm that the Moon goes around the Earth, and that it takes about a month (27.3 days). Then ask the students about the Moon's rotation.

- *Do we ever see the far side of the Moon?*
- *Does the Moon rotate? Why don't we see the far side?*

Have one student volunteer to be the Earth, and a second to be the Moon. The Earth should stand still, while the Moon slowly orbits the Earth, facing the Earth the entire time.

Ask the other students who are observing to discuss the Moon's motion every few steps of the Moon.

- *Is the Moon turning? How much has the Moon rotated with respect to you? Give an answer in degrees.*
- *How long does it take for the Moon to completely turn on its axis?*

Once the Moon volunteer has completed two revolutions, have the students pair up and repeat the demonstrations for themselves, taking turns as the Earth and as the Moon.

Discuss the limitations of this model with the class:
- *In what ways does it accurately reflect the Moon's motion?*
- *In what ways does this model fail?*

Extensions —

1. Demonstrations with an Earth globe and a Moon ball (a plastic ball with a face drawn on one side will suffice.)

2. This kinesthetic activity only works with a percentage of participants; others may be bright but still unable to understand this difficult three-dimensional concept. Conducting the Penny-Quarter Moon Activity, a 2-dimensional model, will help.

Background —

The Moon's period of revolution, or orbit, around the Earth is 27.3 days, which is identical to the Moon's period of rotation, or spin. Because of this, we only see the front side of the Moon.

This wasn't so at first. Over time, the Moon became tidally locked with the Earth—just as the Moon exerts tidal forces on the Earth, our planet also exerts tides on the Moon, slowing down its rotation until it matched its revolution.

The Moon also has two different periods of revolution, depending on your frame of reference. The Moon takes 27.3 days to orbit the Earth exactly 360 degrees, or with respect to the stars (a "sidereal" month). Because the Earth is moving around the Sun, while the Moon orbits the Earth, there is a different period for Moon phases (such as new moon to new moon)—it takes the Moon 29.5 days to complete a lunar phase cycle (a "synodic" month).

Ties to Standards —

Connections to the National Science Standard(s)
Content Standard D Earth and Space Science, (grades 5—8): Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

Principles & Standards for School Mathematics
Geometry Standard for Grades 3-5: Specify locations and describe spatial relationships using coordinate geometry and other representational systems
Reasoning and Proof: Instructional programs from PK through grade 12 should enable all students to make and investigate mathematical conjectures

Texas TEKS
Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
(B) use models to represent aspects of the natural world such as a model of Earth's layers;
(C) identify advantages and limitations of models such as size, scale, properties, and materials;

3rd grade Science Concept Standards (TEKS)
(8) Earth and space. The student knows there are recognizable patterns in the natural world and among objects in the sky. The student is expected to: (C) construct models that demonstrate the relationship of the Sun, Earth, and Moon, including orbits and positions…

5th grade Science Concept Standards (TEKS)
(8) Earth and space. The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to: (D) identify and compare the physical characteristics of the Sun, Earth, and Moon.

6th grade Science Concept Standards (TEKS)
(11) Earth and space. The student understands the organization of our solar system and the relationships among the various bodies that comprise it. The student is expected to: (A) describe the physical properties, locations, and movements of the Sun, planets, Galilean moons, meteors, asteroids, and comets.